SCHOOLEY, (J.C.)

A PROCESS

OF OBTAINING

A DRY COLD CURRENT OF AIR

FROM ICE,

AND

ITS DIFFERENT APPLICATIONS.

INVENTED BY

JOHN C. SCHOOLEY.

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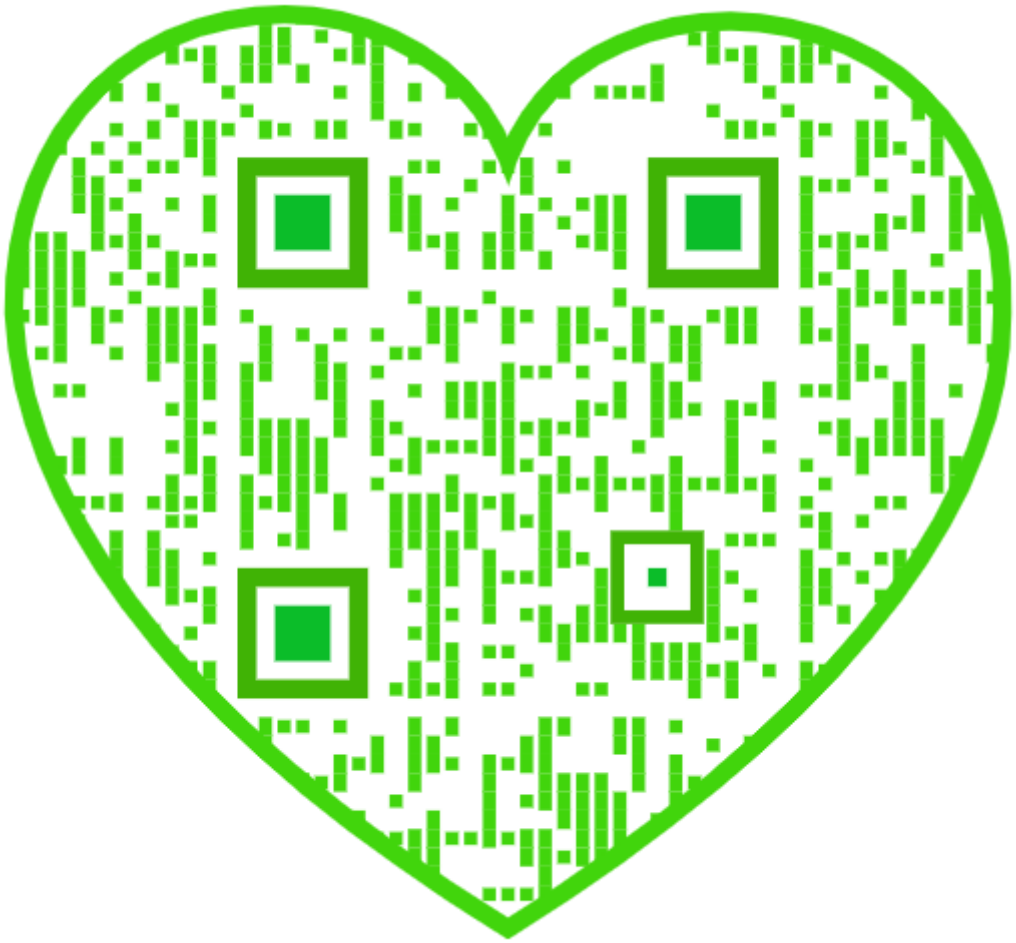
1855.



JOHN C. SCHOOLEY'S

PROCESS OF OBTAINING

A DRY COLD CURRENT OF AIR

FROM ICE.

HISTORY AND PRACTICAL RESULTS.

During the summer of 1848 I made an experiment in producing a cold atmosphere from ice, and applying the same to Refrigerators or Ice Chests; by placing the ice at the top of the apartment to be cooled, and producing my temperature by conduction. Although this had been accomplished before, yet I had an idea of ventilation by constructing tubes, leading from the cooling chamber up through the ice, also tubes leading directly up from the ice chamber; however, before I had completed the Refrigerator I dispensed entirely with the tubes leading from the cooling chamber, but allowed the others to remain. This Refrigerator is now in use, but has never proved of much account, although it preserves provisions with as much success as other Refrigerators of the day. My aim was to get clear of the *moisture*, and produce a *dry* atmosphere; which I did not accomplish.

My business being that of packing and curing Pork and Beef during the winter, and having examined into all of the processes of summer curing with ice, I was confident if the same temperature from ice could be obtained without the

moisture, Pork and Beef could be cured as well in summer as in the winter. The following spring I proposed to a friend (who was in the ice business, and who contemplated erecting a pork house and ice house adjoining each other,) to make his pork house cellar the same depth as his ice house, and to construct an opening between the two, so that he could use the cold air from the ice in the curing of meats during the summer. The building was erected and the door way made, but in consequence of the risk to be incurred in making such an experiment of curing a sufficient quantity of meat in this air so produced, the trial was not made until March, 1854, at which time I took possession of the buildings, and being satisfied that my theory was correct, I embarked in the enterprise. I first made the ceiling of the cellar tight by closing the openings, such as hatchways, stairways, &c.; also constructed a ventilator leading from the top of the cellar up to and through the roof of the building; made with valves, so as they could be closed or opened at will. I then made my contracts for hams and shoulders to be delivered fresh from hogs killed every day throughout the summer, and put the first meat in salt on the 21st of March, 1854, and continued until I had invested about $5,000. My temperature was now 40°, and a strong current of air rushed in from the ice cellar through the opening continually, and as it became warmer ascended and passed out of the ventilator; thus keeping up a *current* of cold atmosphere. I discovered no condensation in my curing chamber, but, on the contrary, the moisture brought in by warm meats, &c., was absorbed and carried off; the salt on my meat sometimes cracked, as it always does just preparatory to freezing; which was a convincing proof of the presence of a dry atmosphere, and that my plan would result successfully. After some twenty-five

days from the first salting, I commenced taking out the salted hams and shoulders for the smoke house, where the results of my operations were to be ascertained, and found that my losses by spoiled meat were far less than I had anticipated. My second smoking in May, produced much less per centage of spoiled meat; my third smoking in June, showed a loss of not exceeding seven per cent. of hams, and six per cent. of shoulders; my fifth smoking still reduced the per centage. These losses were calculated out of the smoke-house, not out of salt. During the entire summer I met with the same success, and before the end of the warm months I had cured successfully upwards of *fifteen thousand dollars* worth of pork, with a loss of spoiled meat averaging not over seven per cent. It must be taken into consideration that a great portion of summer pork is from slop fed hogs, and the meat is more difficult to save than corn fed, even in the winter season. In the winter if corn fed hogs are killed and put in salt in *cold dry* weather, there should be no loss in spoiled meat, but the general average of loss throughout the season of killing and curing in all kinds of atmosphere, is from two to five per cent. It is therefore evident, if we take into consideration the difference in the quality of the meat, that my process has reduced the summer curing equal in success to that of winter curing. Later in the summer my temperature was 52°, (caused by a deficiency of ice, it being owned by other parties who were in the ice business, and who were continually disposing of it,) and in this degree of cold I was compelled to cure my meat until another ice house could be procured. I soon obtained one, which was arranged upon the old plan, with the ice over head, and the temperature produced by conduction; although the apartment was sufficiently cold, the atmosphere was exceedingly moist and

impure, with the condensation hanging in drops on the ceiling, and running down the sides of the walls; here I lost from twenty to twenty-five per cent. in a temperature of 39° and 40°, and here as in my own house, the ice was taken out, (being sold by the owner at some $20 per ton) causing my temperature to be 52° with a moist atmosphere; which state of things continued some thirteen days. I now had an excellent opportunity of ascertaining the difference of curing meats in a dry and moist atmosphere with the following results: In my cellar at 52°, the air being free from moisture, my losses were only nine per cent., and in the moist air, at same temperature, sixty-seven per cent. in shoulders, and sixty per cent. in hams, or nearly three-fourths of the entire meat received during the thirteen days. At the close of the summer, those who had opposed my undertaking commenced to look favorably upon it, and some even went so far as to take drawings of my plans with a view of eventually using the same for their own operations. I at once determined to apply for a patent for my process of producing a *dry cold* atmosphere, so as to apply it to Refrigerators, preservation of fruits, &c., I therefore filed my caveat immediately, and on the 13th of March, 1855, received my Letters Patent. I had submitted my plans and explained my theory to several scientific gentlemen, all of whom looked upon my invention as one of great usefulness, and destined to be of considerable value.

It is a well known fact in Natural Philosophy, that the atmosphere contains variable quantities of moisture; that its capacity for retaining that moisture depends much upon its temperature. If the air be brought in contact with bodies much colder than itself, its capacity for retaining the aqueous vapor is diminished; consequently there will be a deposit of dew, the air thereby becoming drier. As this dried air

becomes warmer, its capacity for moisture will be of course increased, and it will therefore absorb any moisture with which it may come into contact.

It is also a well known fact, (with only one exception,) that the specific gravity of bodies is increased in proportion to the diminution of the temperature—that is, they contract, and of course occupy less space.

It is upon these two philosophical principles that I have constructed my "MEAT, PROVISION AND FRUIT PRESERVER." I pass the air over the surface of ice, which condenses the moisture it may contain; at the same time the air becomes specifically heavier, and then flows into the cooling chamber, where it necessarily becomes warmer and lighter, and, its capacity for moisture increased, it absorbs all of the moisture that may be present in the apartment, then ascending passes out into the external atmosphere, thus producing a *cold dry* current of air continually through the cooling chamber.

The temperature in my curing apartment during the summer ranged from 39 to 48 degrees whilst it was 90 to 95 degrees in the shade outside; and was entirely free from *moisture*, *must*, or *any impure air*, whilst in all other places heretofore used for summer curing, the curing chamber was constantly kept damp by the dripping from the ceiling or a stream of condensed vapor running down the sides of the apartment—creating an impure atmosphere; the result of curing in this moist air was most disastrous, which has heretofore prevented the summer curing process from being of any commercial value.

My plan can be seen in full operation, on a large scale, at any time from the 1st of April until 1st of November, at my establishment, No. 359 Plum street, Cincinnati, O.

The following letter is a review of my process and inven-

tion by Professor J. M. Locke, Analytical Chemist, Mineralogist, &c., Cincinnati, Ohio.

Cincinnati, February 13, 1855.

Dear Sir,—After having examined your plan for curing meat and preserving all kinds of fruits and provisions during warm weather, I have written down the rationale of operation and the authority for the principles involved.

1st. There will be a current of air established down through the ice, thence into the curing or preserving room, from which it will pass up the ventilator. The reason of this action is this. The air in the interstices of the ice gives out its heat to the ice which it melts, and the heat becomes latent (or hidden) in the water thus produced; the ice by being thus cooled is contracted in bulk, and therefore denser, and as all dense substances, it settles to the bottom, and flows into the curing room. By attempting to assume a level in this room it meets with bodies, such as meats, &c., which is warmer than itself, from these bodies it absorbs heat and expands, (Authority, *Graham's Elements of Chemistry*, page 40, Philadelphia, 1852; *Muller's Physics*, page 463, 1848, and *Olmstead's Philosophy*, article 475, N. Y., 1845, and *Poulett*, a Paris, 1846.) The expanded or rarified particles ascend to find an equilibrium, and thus ascend to the top of the ventilator. This action is continuous and produces a current without the aid of any mechanical matter. (Authority, article 476, *On Ventilation of Mines, in Olmstead's Philosophy*.) This can be easily illustrated by taking a U shaped tube, as in Fig. 1, and place some mercury in the curved part, then pour water in the long leg at A, the mercury would rise about one inch in the leg C for each foot of water in A, on account of the difference of their density; now suppose the leg C to be the ice room and to have the power (as has been seen before) of condensing the air, which would therefore support a taller column of rarified air; but if the column A is not sufficiently tall to hold a quantity of the rarified air to balance the dense air in C, then it would be forced out and produce a current. This is the action in the ordinary chimney.

Fig. 1.

2d. Air can only hold a certain proportion of vapor of water suspended in it according to its temperature, the lower the temperature the less is it capable of holding, for we determine the quantity of moisture which the air contains by observing at what reduced temperature it commences to deposit it as mist or dew. (*Daniel's Meteorological Essays*, page 147.) Muller says, "If on a hot summer's day, at a temperature of 77 degrees, every cubic metre of air contains 13 grams (200,76 grs.) of vapor, we say the air is very dry, for at such a temperature the atmosphere can contain 22.5 grams of vapor for every cubic metre of air, otherwise the air must be cooled to 59 degrees, in order to be saturated by the same quantity of aqueous vapor; if, on the contrary, in winter, at a temperature of 35°6, the air contains only 6 grams of vapor, it is very damp, since the atmosphere is nearly perfectly saturated with vapor, corresponding to that temperature, and the least decrease of temperature is followed by a precipitation of moisture."—*Muller*, page 594.

We will now attempt to apply these facts to our purpose; when the air passes amongst the pieces of ice, its temperature is reduced, and a large portion of moisture

deposited, as its capacity for holding aqueous vapor has been decreased. It then enters into the curing room where the temperature is enhanced as before mentioned, and it then has power to absorb additional aqueous vapor, which it does and is carried off, as previously mentioned.

Let us for a moment look to the action; if the curing room was surrounded by or the ice was placed at the top, as in the Baltimore, or other old plans, which produce their temperature by conduction; if we had the ventilator in these cases, we would have the current reversed. The air which passes into the room does not come in direct contact with ice, and all of the moisture of this ingressing air would be deposited in the curing room, whereby instead of drying it, it would add moisture. Some would probably object to the air not passing through your room with greater speed, but 'Graham' settles this, by stating "It should be kept in mind that a certain time must elapse before air is saturated with humidity. Mr. Daniel has observed that a few cubic inches of dry air continued to expand for an hour or two when exposed to water at the temperature of the air." *Graham's Elements of Chemistry*, page 95.

The following are what I conceive to be the advantages of your arrangement:

1st. You establish a current without other means than those which Nature furnishes.

2nd. All the cooling effected by the melting of the ice is applied in the curing room.

3rd. There is a current of air in the curing room which wastes none of its cooling properties, and furnishes fresh air to operations.

4th. The curing room is kept dry, and things which are moist when placed therein are dried.

Yours, most respectfully,

JOSEPH M. LOCKE.

JOHN C. SCHOOLEY, Esq., Cincinnati.

It is well known that in preserving meats from decomposition from the effects of heat or a high temperature that ice has been used and applied in a variety of forms, but not sufficiently successful to render any of the methods used of any commercial value. It has been found in curing meats in particular that the atmosphere should be in a certain condition to render it successful. The conditions are first, a certain degree of cold, and, secondly, a certain state of dryness, and without these conditions, all will prove a failure if attempted. For instance, a temperature of 48° is sufficiently cold, but dampness even at that degree of cold will make it prove a failure, that is, there will be such a quantity of spoiled meat that the undertaking will result disastrously.

Why? Because the humid air will not allow the salt to abstract the liquids from the meat, which are the causes of decomposition, if allowed to remain with the solid particles when exposed to a warm and moist atmosphere, and in all the methods invented for curing meats with the use of ice, the presence of too much dampness in the atmosphere has been the only difficulty to contend against.

I obtain the warm meat from the hog as soon after killed as possible, and spread the pieces over my floor or hang them up exposed to this dry cold atmosphere over night, and in the morning I place them in salt, and so on from day to day. If I wish to cure in sugar pickle, I allow the meat to be in dry salt from three to five days (overhauling it once in the mean time) I then have the casks arranged along the sides of the apartments, and place the meat into the pickle and cure as in winter. The evaporation aids in cooling the pickle, otherwise the temperature of the pickle will be greater than its temperature if covered.

Fig. 1.

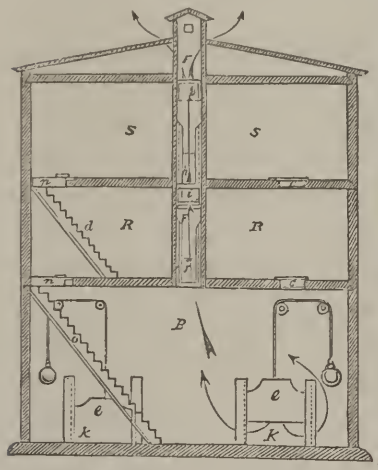
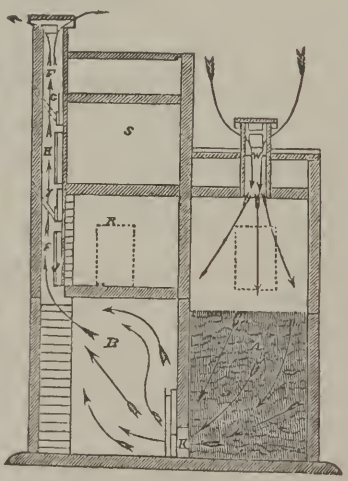


Fig. 2.



To enable others skilled in the art to make and use my

mprovement in its application to pork houses, I will proceed to describe its construction and operation by refering to the above cuts, and the letters of reference marked thereon.

Fig. 1, represents a longitudinal sectional elevation through the pork house showing openings that permit the air to come from the ice.

Fig. 2 represents a transverse sectional elevation of the curing apartment, and ventilating flue furnished with valves for retaining or permitting the air to escape as may be required.

The structure in the present drawing represents a pork house with an ice cellar by its side, and the house is also furnished with a cellar B, (or, if desired, two cellars can be made) in which the meats or other provisions may be cured or packed, and which is made about twenty feet deep more or less, as the demand may require. The ice cellar A is of corresponding depth. The two cellars are connected together by openings k. k. furnished with doorways e. e. which can be closed or opened at pleasure. The ice in the cellar is filled up some four or six feet above the surface of the ground, and at all times is kept above the openings k. k. in the partition wall, so that the warm atmosphere will not find its way into the curing cellar B, and thereby at all times secure a cold current of air from the surface of ice into the curing room or cellar B, by having the air to pass down over the ice, and become cold, depositing its moisture upon its cold surface, and then pass into the curing room B, sufficiently cold and dry. But in consequence of an introduction of warm meats the air in the cellar B again becomes partially moist and warmer. This air is then conducted off through the the ventilating flue, f., f., which is provided with valves, either to retain it or allow it to escape out at the roof of the building or into either of the rooms R & S above the cellar B.

When it is desired to free the cellar B of this moist and warm air all of the valves g. h. i. & j. are closed in the side of the ventilating flue as represented in Fig. 2, which permits the air to escape as indicated by the darts marked through the ventilating flue and out at its top, and when the air which rises from the cellar B is wanted in the rooms R & S above it, all the valves are opened, which causes the air to pass through each room to escape through the top of the ventilator; o. & d. represent steps for descending into the curing room and ascending to the upper story. n. & n. are doorways at the top of the steps, and made to fit tight in order to retain and exclude the air as may be required. c, c, represent hatchways, through the two floors for the purpose of elevating and lowering provisions. w. is an opening in the roof over the ice cellar to admit the atmosphere as the spears indicate, which passes down over the surface of the ice, and thereby made cold, depositing its moisture upon it, then passing out at the openings k. k. into the curing room B, and then thoroughly filling and circulating through all parts of the room, and as it becomes moistened and warmed it passes out of the apartment through the ventilator f. f. as represented by the darts marked therein to denote the course of the air. The advantage of placing the ice house adjoining the pork house is to allow the ice dealer the use of it free during the season provided he agrees to keep sufficient ice on hand at all times above the openings k. k. In this case the pork packer need not own the ice, but receive the benefit of its proximity, thus doing away with a great expense in summer curing.

During the last summer in my establishment, a current of cold dry air was kept up from the ice throughout the season and the extra meltings calculated at the then, high

market price, amounted to not exceeding *thirty dollars*. Establishments built after the old plan, with the ice at the top or sides, can be easily altered at a very little expense. Drawings and directions showing the mechanical structure of such a change can be had by application to the patentee.

MEAT, PROVISION, AND FRUIT PRESERVER.

In making the application of my process to the PRESERVER, the ice is placed at the top of the chamber, or at the side if desired, but I have found it more convenient to have it placed above. A register is counter sunk in the top of the lid of each Preserver, also, an oblong opening is made at the side of the ice chamber leading into a flue, which extends down to the bottom of the preserving apartment, and at the top of the opposite side from this flue another register is placed to allow the expanded atmosphere to escape—this register is covered on the inside with fine wire gauze, so as to prevent the admission of flies, or other insects. We therefore have the air passing in at the top, and when it comes in contact with the ice, it contracts, and be-

comes more dense,—passing over the ice, deposits its moisture upon it, and flows down into the preserving apartment through the flue leading from the ice chamber; as this dry air absorbs a greater portion of the moisture with which it comes in contact, it passes out through the side register into the external atmosphere.

The inside of the preserving apartment is at all times perfectly *dry and cool*, and every description of provisions can be kept free from *mould, must, or smell,* almost any length of time. Such articles as fresh butter, milk, beefsteak, melons, cucumbers, onions, &c., will not contract smell from each other, and the instant any smell or flavor is emitted from any vegetable, it is carried out by the continued current of air before any time is given for impregnation. It is the first Preserver ever invented, free from *moisture.*

Housekeepers will at once appreciate the difference between this and the old description of Refrigerator or ice chest.

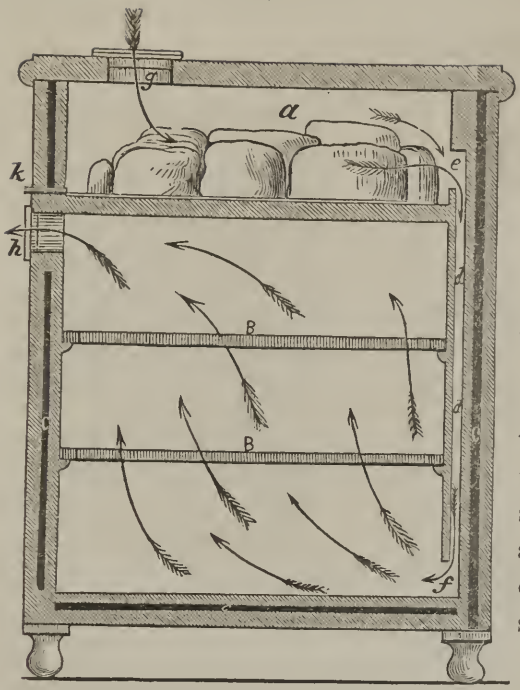
My plan melts *less ice* than in the ordinary ice chest, where vegetables come in contact with the ice—and after the Preserver is sufficiently cooled—five pounds of ice will keep it as cold as twenty pounds. The meltings of the ice is carried off from the water cell between the floor of the chamber and the bottom of the ice, by a pipe, to which is attached a cock to turn on or off at will.

The ice chamber should be lined with a water tight pan of zinc or galvanized iron—with this exception, metal lining is entirely dispensed with, and well seasoned ash wood is used instead.

To enable others to make and use my Preserver, I proceed to describe its construction, as in Figs. 1, 2 and 3.

Fig. 1, represents a longitudinal sectional elevation of the

Fig. 1.



Preserver, showing the manner of admitting the air into the ice chamber, over and around the surface of ice, thence through an opening, and descending thro' a flue into the lower part of the Preserver up through the shelves, and out at the sides as denoted by the spears.

Fig. 2, represents a transverse sectional elevation of the same, and Fig. 3, a horizontal sectional view showing the top of one of the shelves. a. is a chamber at the top of the preserver for containing ice, and air is admitted at the opening g. which should be provided with a suitable register for regulating the quantity. The air passes over and around the surface of the ice (as represented in the ice chamber) becomes cold and passes into the opening, e. and descends the flue d. d. and from thence into the preserving chamber through the opening f. and up through the open made shelves B B and out at the opening h. (which is also provided with a register;) c. c. are spaces left in the walls of the Preserver for insulators. i. is the inner door to the Preserver, which can be divided into smaller doors if desired, and j. the outer

Fig. 2.

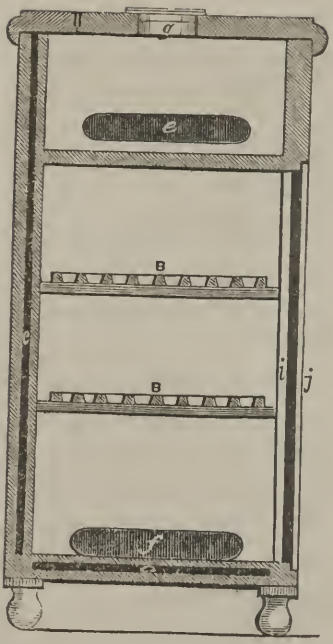
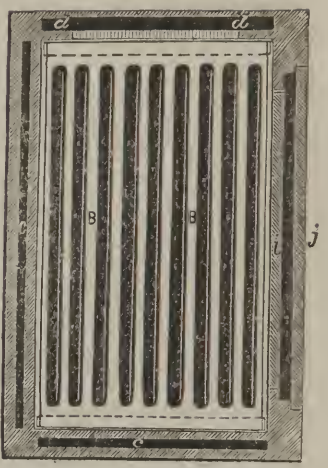


Fig. 3.



door; k is a pipe for drawing off the water melted from the ice.

Dimensions.	Inches High.	Long.	Wide.	
No. 1,	28	36	24	ice at the side.
No. 2,	43	28	21	ice at the top with water cooler.
No. 3,	46	31	24	do do do do do
No. 4,	46	37	25	do do do do do

Directions.—Place the ice in the ice chamber in close proximity to the perforated openings through which the atmosphere passes into the flue.

If a continual current of air is desired the registers must always remain open; in this case the preserving chamber will be free from *must*, *mould*, *moisture*, or offensive smell.

To prevent contamination.—Vegetables or other articles emiting a smell, should be placed next towards the register

through which the air passes out into the external atmosphere; and milk and butter should be placed near where the cold air flows into the preserving chamber.

Care should be taken to draw off the waste water, otherwise it may overflow and run down into the preserving chamber.

PRESERVATION OF FRUITS.

My plan for the preservation of fruits in warm or moist climates, is one long desired by fruiterers, particularly in the southern States.

My idea is, to construct buildings similar to my Pork house, entirely above the ground, with the ice at the side, ends or in the center, with fruit rooms adjoining, in and through which, the dry cold current of air is passed, then out at the top as in Fig. 1 and 2 of Pork house. I have not the least doubt that all kinds of fresh and preserved fruits can be kept during the summer free from decay and fermentation, in this dry and pure atmosphere, where the temperature is not over 48°. It is very seldom that the temperature will ever become warmer than this degree, if my plans are carried out correctly.

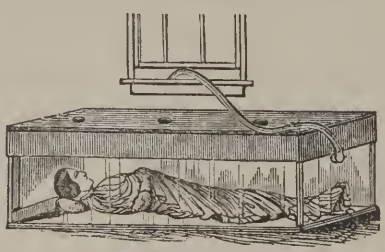
I propose to construct a large establishment adjoining an ice house, and divide it into small apartments surrounding a large store room, through which is carried this current of dry cold air, in the manner already described; and in this room, fruit merchants could store their oranges, lemons, raisins, &c, throughout the summer—thus preserving their fruit from the ravages of a moist and warm atmosphere. The small apartments to be each supplied with a lock and key, and rented out to the Pork and Beef butchers standing in the market, who could thus preserve their fresh meats left over from morning to morning.

If any ice dealer would construct an establishment on this plan, they would find it to be of considerable pecuniary advantage. I believe that ripe strawberries, and other fruit can be purchased in New Orleans, or other southern ports, placed in one of my preservers, and shipped to the northern cities, coming out as fresh and as sound as when placed therein.

COLD STRAINED OIL.

Oil merchants have made many attempts to chill their oil during the summer so as to produce a cold strained article, which always commands a higher price than the summer strained. Some lard oil manufacturers have outlayed thousands of dollars in building ice houses and filling them with ice for this purpose, but they have ascertained that it is necessary to have a *dry* cold atmosphere so as to make their project successful. Moisture produces rancidity and mould, and the air being impregnated with such impurities, the oil partakes of the smell, and of course proves disastrous. In my plan these difficulties are obviated, and the oil can be chilled, imparting a flavor as sweet and pure as in the cold winter season.

"CORPSE PRESERVERS."



Although many plans have been in use for the preservation of dead bodies by undertakers, yet all are objectionable, and revolting to the feelings particularly when the

body is placed in contact with ice, or even placed in any apartment where cold is produced by conduction.

My plan is to construct a proper shaped chamber to hold a sufficient quantity of ice for the purpose, placed either at the top or ends of a case formed of thick plate glass, or entirely of wood, made air tight with the exception of the registers. The cold dry atmosphere is produced in the same manner as before described, thus preserving the corpse much better and longer than in any other plan. This plan will require but half of the quantity of ice usually consumed for this purpose; and the 'Preserver' will be of light construction, and can be removed from place to place by the undertaker without much difficulty.

VENTILATION OF BUILDINGS, PUBLIC HALLS, ETC.

Much has been said and many plans have been brought into requisition for the purpose of ventilating assembly rooms during the summer season. Immense sums have been appropriated by the general government for the proper ventilation of the capital at Washington, but none of the plans have proved successful. I have no hesitation in saying that I can (with my application of producing a dry atmosphere), ventilate any public hall or assembly room during an external temperature of 95°, and produce a pure refreshing atmosphere free from any dampness flowing through the apartment at a temperature of 60° to 70°, if required, at a cost but trifling in comparison to the result obtained.

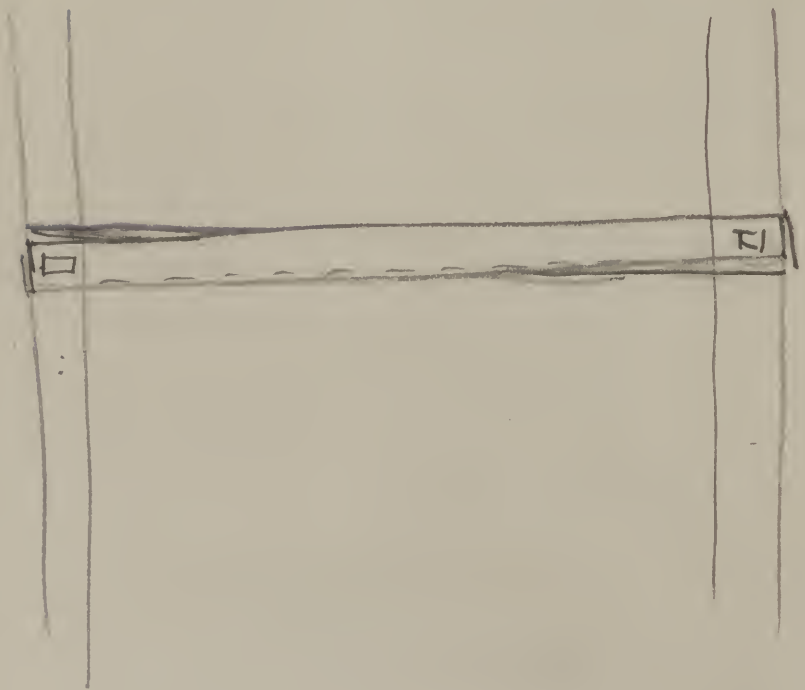
And in fact there seems to be no end to the uses my invention can be applied to.

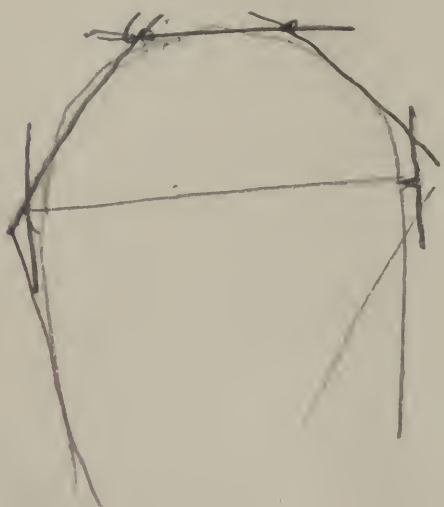
INFRINGEMENT.—Notice is hereby given to all parties infringing on this patent, that prosecution will be commenced immediately, and the law carried out to its fullest extent.

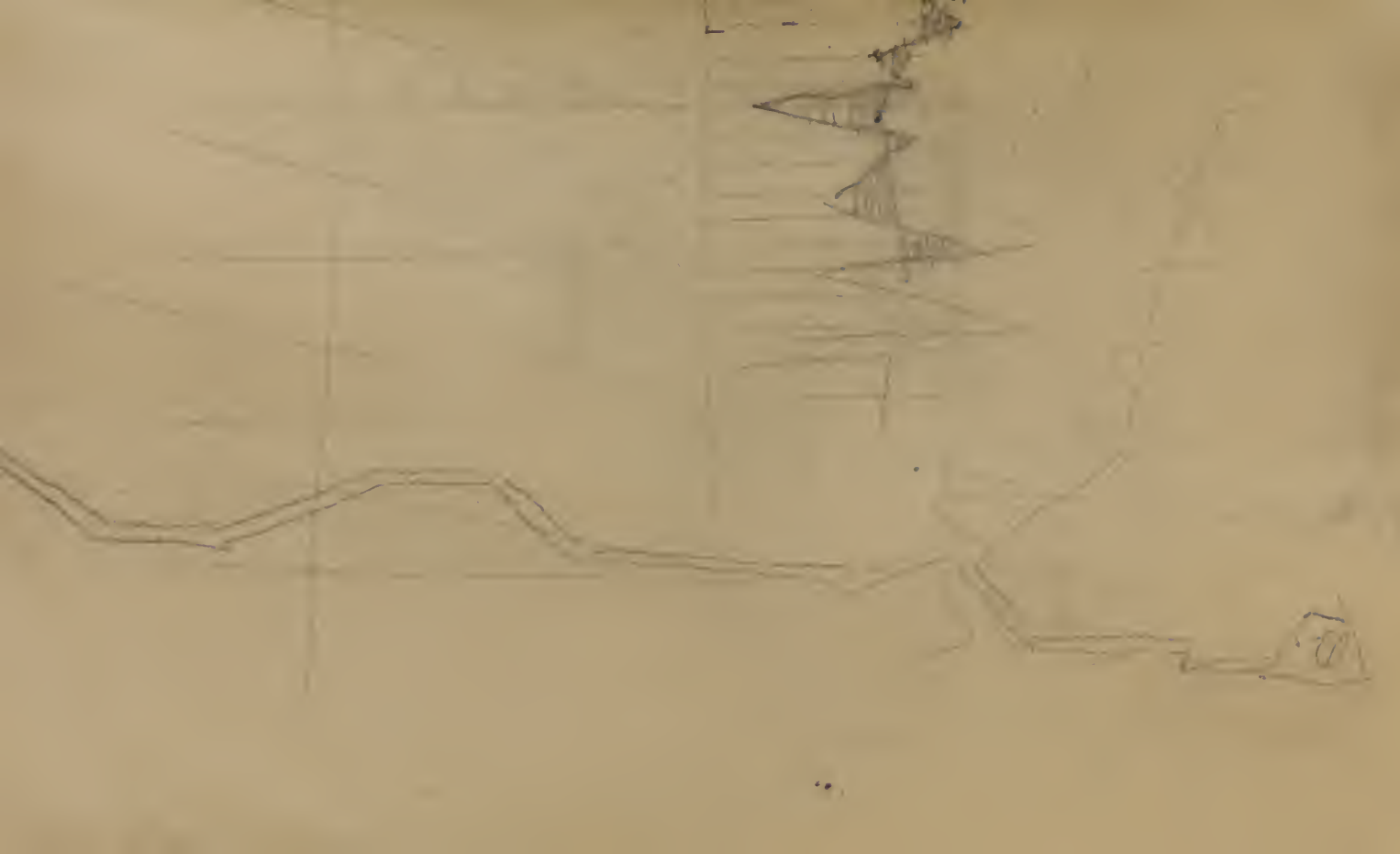
For particulars concerning the purchase of Rights for States, Counties and Cities, application can be made at my office, where the process can be seen in full operation.

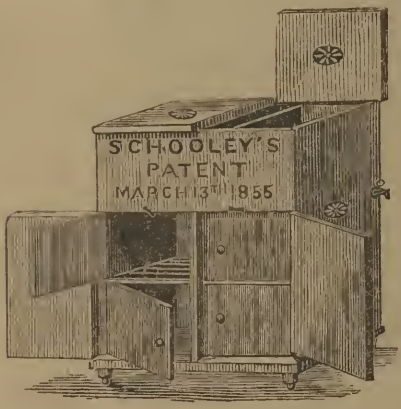
Address JOHN C. SCHOOLEY

Cincinnati, O.





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MARCH 13TH 1855